

# *Gulf Cooperation Council*

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GSO 66 (1987) (English): INDUSTRIAL SAFETY AND  
HEALTH REGULATIONS - HAZARDOUS MATERIALS - PAINTS -  
PART 1: SPRAY FINISHING USING FLAMMABLE



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قابلة للاشتعال

**INDUSTRIAL SAFETY AND HEALTH REGULATIONS –  
HAZARDOUS MATERIALS – PAINTS – PART 1:  
SPRAY FINISHING USING FLAMMABLE**

**ICS:13.100**

**INDUSTRIAL SAFETY AND HEALTH REGULATIONS –  
HAZARDOUS MATERIALS – PAINTS – PART 1:  
SPRAY FINISHING USING FLAMMABLE  
AND COMBUSTIBLE MATERIALS**

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**INDUSTRIAL SAFETY AND HEALTH REGULATIONS –  
HAZARDOUS MATERIALS – PAINTS – PART 1:  
SPRAY FINISHING USING FLAMMABLE  
AND COMBUSTIBLE MATERIALS**

**1. SCOPE AND FIELD OF APPLICATION**

This Standard is concerned with flammable and combustible finishing materials when applied as a spray by compressed air, “Airless” or “Hydraulic Atomization”, steam, electrostatic methods, or by any other means in continuous or intermittent processes. It also covers the application of combustible powders by powder spray guns, electrostatic powder spray guns fluidized beds, or electrostatic fluidized beds. It does not apply to outdoor spray application of buildings, tanks, or other similar structures, nor to small portable spraying apparatus not used repeatedly in the same location.

**2. COMPLEMENTARY REFERENCES**

- 2.1 GSO 218/1994 “Industrial Safety and Health Regulations - Electrical - Low Voltage”.
- 2.2 GSO 62/1987 “Industrial Safety and Health Regulations - Hazardous Materials - Flammable and Combustible Liquids - Part 1: Tanks, Piping and Accessories”.

**3. DEFINITIONS**

- 3.1 Aerated Solid Powders: Any powdered material used as a coating material which shall be fluidized within a container by uniformly passing air from below. It is common practice to fluidize such materials to form a fluidized powder bed and then dip the part to be coated into the bed in a manner similar to that used in liquid dipping.
- 3.2 Dry Spray Booth: A spray booth not equipped with a water washing system as described above. A dry spray booth may be equipped with:
  - Distribution or baffle plates to promote an even flow of air through the booth or cause the deposit of overspray before it enters the exhaust duct; or
  - Overspray dry filters to minimize dusts; or
  - Overspray dry filters to minimize dusts or residues entering exhaust ducts; or
  - Overspray dry filter rolls designed to minimize dusts or residues entering exhaust ducts; or
  - Where dry powders are being sprayed, with powder collection systems so arranged in the exhaust to capture oversprayed material.

- 3.3      Electrostatic Fluidized Bed: A container holding powder coating material which is aerated from below to form an air-supported expanded cloud of such material which is electrically charged with a charge opposite to the charge of the object to be coated; such object is transported through the container immediately above the charged and aerated materials in order to be coated.
- 3.4      Fluidized Bed: A container holding powder coating material which is aerated from below so as to form an air-supported expanded cloud of the material in which the preheated object to be coated is immersed and transported.
- 3.5      Spray Booth: A power-ventilated structure provided to enclose or accommodate a spraying operation to confine and limit the escape of spray, vapour, and residue, and to safely conduct or direct them to an exhaust system.
- 3.6      Spraying Area: Area in which dangerous quantities of flammable vapours or mists, or combustible residues, dusts, or deposits are present due to the operation of spraying processes.
- 3.7      Waterwash Spray Booth: A spray booth equipped with a water washing system designed to minimize dusts or residues entering exhaust ducts and to permit the recovery of overspray finishing material.

#### **4. REGULATIONS**

##### **4.1 Spray Booths**

###### **4.1.1 Construction**

Spray booths shall be constructed mainly of steel, securely and rigidly supported, or of concrete or masonry except that aluminium or other substantial noncombustible material may be used for intermittent or low volume spraying. Spray booths shall be designed to sweep air currents toward the exhaust outlet.

###### **4.1.2 Interiors**

The interior surfaces of spray booths shall be smooth and continuous without edges and otherwise designed to prevent pocketing of residues and facilitate cleaning and washing without injury.

###### **4.1.3 Floors**

The floor surface of a spray booth and operator's working area, if combustible, shall be covered with noncombustible material of such character as to facilitate the safe cleaning and removal of residues.

###### **4.1.4 Distribution of Baffle Plates**

Distribution of baffle plates, if installed to promote an even flow of air through the booth or cause the deposit of overspray before it enters the exhaust duct, shall be of noncombustible material and readily removable or accessible on both sides for cleaning. Such plates shall not be located in exhaust ducts.

###### **4.1.5 Dry Type Overspray Collectors - (Exhaust Air Filters)**

In conventional dry type spray booths, overspray dry filters or filter rolls, if installed, shall conform to the following:

- 4.1.5.1 The spraying operations other than electrostatic ones shall be designed, installed and maintained so that the average air velocity over the open face of the booth (or booth cross section during spraying operations) shall be not less than 30 linear m/min. Electrostatic spraying operations may be conducted with an air velocity over the open face of the booth of not less than 18 linear m/min, or more, depending on the volume of the finishing material being applied and its flammability and explosion characteristics. Visible gauges or audible alarm or pressure activated devices shall be installed to indicate or insure that the required air velocity is maintained. Dry spray booths equipped with a filter roll which is automatically advanced when the air velocity is reduced to that specified in this standard should be arranged to shutdown spraying operations if the filter roll fails to advance automatically. Maintenance procedures should be established to assure replacement of filter pads before excessive restriction to airflow occurs. Filter pads should be inspected after each period of use and clogged filter pads discarded and replaced. Filter rolls shall be inspected to assure proper replacement of filter media.
- 4.1.5.2 All discarded filter pads and filter rolls shall be immediately removed to a safe, well-detached location or placed in a water-filled metal container and disposed of at the close of the day's operation unless maintained completely in water.
- 4.1.5.3 The location of filters in a spray booth shall be so as not to reduce the effective booth enclosure of the articles being sprayed.
- 4.1.5.4 Space within the spray booth on the downstream and upstream sides of filters shall be protected with approved automatic sprinklers.
- 4.1.5.5 Filters or filter rolls shall not be used when applying a spray material known to be highly susceptible to spontaneous heating and ignition.
- 4.1.5.6 Clean filters or filter rolls shall be noncombustible type or which when clean burn moderately when attacked by flame and/or which emit moderate amounts of smoke. Filters and filter rolls shall not be alternately used for different types of coating materials, where the combination of materials may be conducive to spontaneous ignition. See also item 4.6.6.
- 4.1.6 Frontal Area
- Each spray booth having a frontal area larger than 0.8 sq. m shall have a metal deflector or curtain not less than 6.5 cm deep installed at the upper outer edge of the booth over the opening.
- 4.1.7 Conveyors
- Where conveyors are arranged to carry work into or out of spray booths, the openings shall be as small as practical.
- 4.1.8 Separation of Operations



Each spray booth shall be separated from other operations by not less than 90 cm, or by a greater distance, or by such partition or wall as to reduce the danger from juxtaposition of hazardous operations. See also item 4.2. 1.

#### 4.1.9 Cleaning

Spray booths shall be so installed that all portions are readily accessible for cleaning. A clear space of not less than 90 cm on all sides shall be kept free from storage or combustible construction.

#### 4.1.10 Illumination

When spraying areas are illuminated through glass panels or other transparent materials, only fixed lighting units shall be used as a source of illumination. Panels shall effectively isolate the spraying area from the area in which the lighting unit is located, and shall be of a noncombustible material of such a nature or so protected that breakage will be unlikely. Panels shall be so arranged that normal accumulations of residue on the exposed surface of the panel will not be raised to a dangerous temperature by radiation or conduction from the source of illumination.

Electrical and Other Sources of Ignition

### 4.2 Electrical and Other Sources of Ignition

#### 4.2.1 Conformance

All electrical equipment, open flames and other sources of ignition shall conform to the requirements of this item, except as follows:

- Electrostatic apparatus shall conform to the requirements of items 4.7 and 4.8;
- Drying, curing, and fusion apparatus shall conform to the requirements of item 4.9;
- Automobile undercoating spray operations in garages shall conform to the requirements of item 4.10;
- Powder coating equipment shall conform to the requirements of this item.

#### 4.2.2 Area Classification

4.2.2.1 The interiors of spray booths and their exhaust ducts, all space within 6 m horizontally in any direction and 3 m vertically from spraying operations more extensive than touch-up spraying and not conducted within spray booths and all other spaces where hazardous concentrations of flammable vapours are likely to occur shall be classified as Class 1, Division 1 locations.

4.2.2.2 The following spaces shall be considered Class 1, Division 2 locations:

- 4.2.2.2.1 For extensive open spraying, all space outside of, but within 6 m horizontally and 3 m vertically of the Class 1, Division 1 location as defined, and not separated from it by partitions. (See Figure 1).
- 4.2.2.2.2 For spraying operations conducted within a closed top, open face or front spray booth, the space shown in Figure 2 or the space within 1 m in all directions from openings other than the open face or front. The Class 1, Division 2 location shown in Figures 2 and 3 shall extend from the open face or front of the spray booth in accordance with the following:

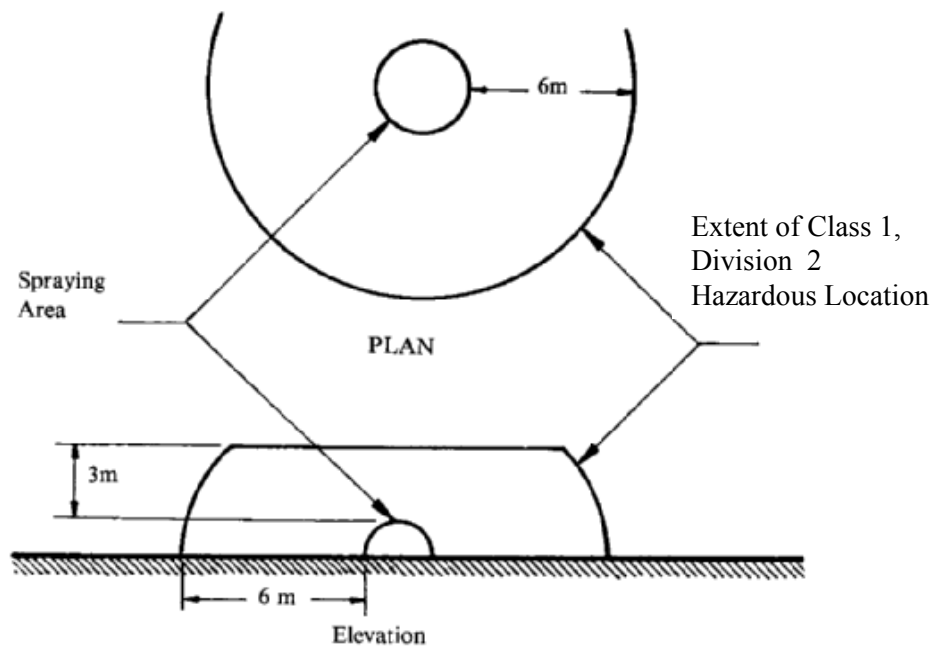


Figure 1

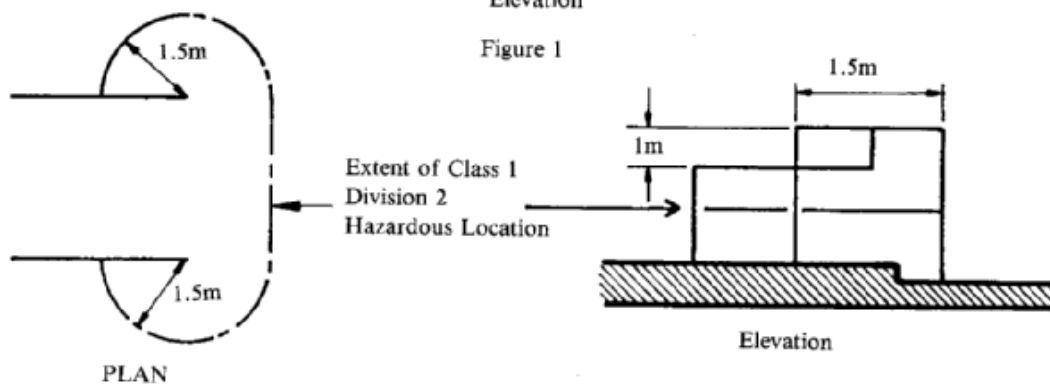


Figure 2

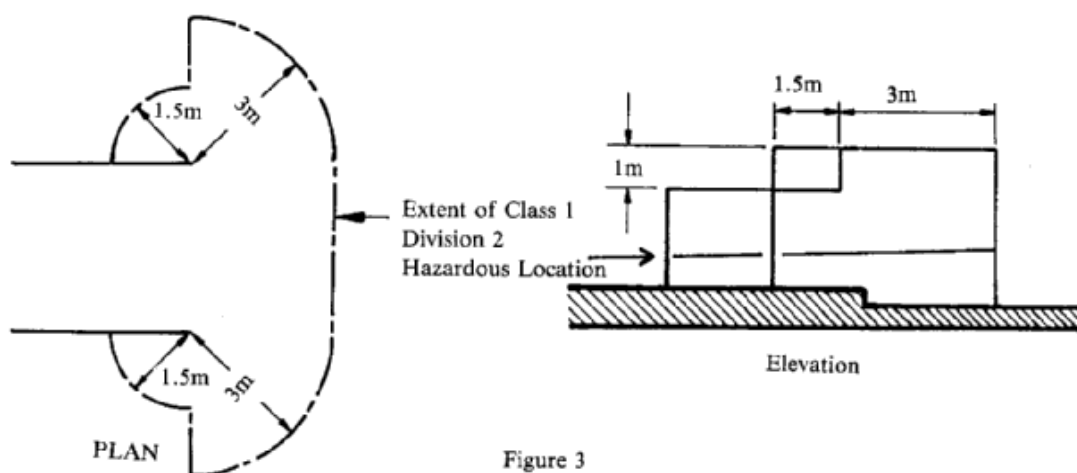


Figure 3

- 4.2.2.2.2.1 If the ventilation system is interlocked with the spraying equipment so as to make the spraying equipment inoperable when the ventilation system is not in operation, the space shall extend 1.5 m from the open face or front of the spray booth, and as otherwise shown in Figure 2.
- 4.2.2.2.2.2 If the ventilation system is not interlocked with the spraying equipment so as to make the spraying equipment inoperable when the ventilation system is not in operation, the space shall extend 3 m from the open face or front of the spray booth, and as otherwise shown in Figure 3.
- 4.2.2.2.3 For spraying operations conducted within an open top spray booth, the space 1.5 m above the booth and within the space shown in Figure 3 as Class 1, Division 2 location adjacent to openings.
- 4.2.2.2.4 For spraying operations confined to an enclosed spray booth, the space within 1 m in all directions from any openings in the spray booth.
- 4.2.3 Minimum Separation
- There shall be no open flame or spark producing equipment in any spraying area nor within 6 m thereof, unless separated by a partition.
- 4.2.4 Hot Surfaces
- Space-heating appliances, steampipes, or hot surfaces shall not be located in a spraying area where deposits of combustible residues may readily accumulate.
- 4.2.5 Combustible Residues, Areas .
- There shall be no electrical equipment in any spraying area, whereon deposits of combustible residues may readily accumulate, except wiring in rigid conduit or in boxes or fittings containing no taps, splices, or terminal connections.
- 4.2.6 Wiring Type Approved
- Electrical wiring and equipment not subject to deposits of combustible residues but located in a spraying area as herein defined shall be of explosion-proof type approved for Class 1, Group D locations and shall otherwise conform to the Gulf Standard mentioned in item 2.1 (area classification), for Class 1, Division 1, Hazardous Locations.
- 4.2.7 Lamps
- Electrical lamps outside of, but within 6 m of any spraying area, and not separated therefrom by a partition, shall be totally enclosed to prevent the falling of hot particles and shall be protected from mechanical injury by suitable guards or by location.
- 4.2.8 Portable Lamps
- Portable electric lamps shall not be used in any spraying area during spraying operations. Portable electric lamps, if used during cleaning or repairing operations, shall be of the type approved for area class.

**4.2.9 Grounding**

All metal parts of spray booths, exhaust ducts, and piping systems conveying flammable or combustible liquids or aerated solids shall be electrically grounded in an effective and permanent manner.

“Airless” high-fluid pressure spray guns and any conductive object being sprayed shall be electrically grounded.

**4.3 Ventilation****4.3.1 Conformance**

Ventilating and exhaust systems shall be in accordance with the Gulf Standard “Occupational Health and Environmental Control” where applicable and shall also conform to the provisions of this standard

**4.3.2 General**

All spraying areas shall be provided with mechanical ventilation to remove flammable vapours, mists, or powders to a safe location and to confine and control combustible residues so that human life is not endangered. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapours from drying coated articles and drying finishing material residue to be exhausted.

**4.3.3 Independent Exhaust**

Each spray booth shall have an independent exhaust duct system discharging to the exterior of the building, except that the multiple cabinet spray booths in which identical spray finishing material is used with a combined frontal area of not more than 1.7 sq m may have a common exhaust. If more than one fan serves one booth, all fans shall be so interconnected that one fan cannot operate without all fans being operated.

**4.3.4 Fan-Rotating Element**

The fan-rotating element shall be nonferrous of nonsparking material or the casing shall consist of or be lined with such material. There shall be ample clearance between the fanrotating element and the fan casing to avoid a fire by friction, necessary allowance being made for ordinary expansion and loading to prevent contact between moving parts and the duct or fan housing. Fan blades shall be mounted on a shaft sufficiently heavy to maintain perfect alignment even when the blades of the fan are heavily loaded, the shaft preferably to have bearings outside the duct and booth. All bearings shall be of the self-lubricating type, or lubricated from the outside duct.

**4.3.5 Electric Motors** Electric motors driving exhaust fans shall not be placed inside booths or ducts. See item 4.3.**4.3.6 Belts**

Belts shall not enter the duct or booth unless the belt and pulley within the duct or booth are thoroughly enclosed.

**4.3.7 Discharge Clearance**

Unless the spray booth exhaust duct terminal is from a water-wash spray booth, the terminal discharge point shall be not less than 1.8 m from any combustible exterior wall or roof nor discharge in the direction of any combustible construction or unprotected opening in any noncombustible exterior wall within 7.5 m.

**4.3.8 Air Exhaust**

Air exhaust from spray operations shall not be directed so that it will contaminate makeup air being introduced into the spraying area or other ventilating intakes, nor directed so as to create a nuisance. Air exhausted from spray operations shall not be recirculated.

**4.3.9 Room Intakes**

Air intake openings to rooms containing spray finishing operations shall be adequate for the efficient operation of exhaust fans and shall be so located as to minimize the creation of dead air pockets.

**4.3.10 Drying Spaces**

Freshly sprayed articles shall be dried only in spaces provided with ventilation to prevent the formation of explosive vapours. In the event adequate and reliable ventilation is not provided, such drying spaces shall be considered a spraying area. See item 4.9.

**4.4 Flammable and Combustible Liquids - Storage and Handling****4.4.1 Conformance**

The storage of flammable or combustible liquids in connection with spraying operations shall conform to the requirements of the Gulf Standard mentioned in item 2.2.

**4.4.2 Quantity**

The quantity of flammable or combustible liquids kept in the vicinity of spraying operations shall be the minimum required for operations and should ordinarily not exceed a supply for one shift. Bulk storage of portable containers of flammable or combustible liquids shall be in a separate, constructed building detached from other important buildings or cut off in a standard manner.

**4.4.3 Containers**

Original closed containers, approved portable tanks, approved safety cans or a properly arranged system of piping shall be used for bringing flammable or combustible liquids into spray finishing room. Open or glass containers shall not be used.

**4.4.4 Transferring Liquids**

The withdrawal of flammable and combustible liquids from containers having a capacity of greater than 225 litres shall be by Standardization & Metrology Organization for GCC Countries approved pumps, except as provided in item 4.4.5. The withdrawal of flammable or combustible liquids from containers and

the filling of containers, including portable mixing tanks, shall be done only in a suitable mixing room or in a spraying area when the ventilating system is in operation. Precautions shall be taken to protect against liquid spillage and sources of ignition.

#### 4.4.5 Spraying Containers

Containers supplying spray nozzles shall be of closed type or provided with metal covers kept closed. Containers not resting on floors shall be on metal supports or suspended by wire cables. Containers supplying spray nozzles by gravity flow shall not exceed 35 litres capacity. Original shipping containers shall not be subject to air pressure for supplying spray nozzles. Containers under air pressure supplying spray nozzles shall be of limited capacity not exceeding that necessary for one day's operation, designed and approved for such use provided with a visible pressure gauge and provided with a relief valve set to operate at pressure not exceeding maximum allowable working pressure of the container.

#### 4.4.6 Pipes and Hoses

4.4.6.1 All containers or piping to which a hose or flexible connection is attached shall be provided with a shut-off valve at the connection. Such valves shall be kept shut when spraying operations are not being conducted.

4.4.6.2 When a pump is used to deliver products, automatic means shall be provided to prevent pressure in excess of the design working pressure of accessories, piping, and hose.

4.4.6.3 All pressure hose and couplings shall be inspected at regular intervals appropriate to this service. The hose and couplings shall be tested with the hose extended, and using the "Inservice Maximum Operating Pressures". Any hose showing material deteriorations, signs of leakage, or weakness in its carcass or at the couplings, shall be withdrawn from service and repaired or discarded.

4.4.6.4 Piping systems conveying flammable or combustible liquids shall be of steel or other material having comparable properties of resistance to heat and physical damage. Piping systems shall be bonded and grounded.

#### 4.4.7 Spray Liquid Heaters

Electrically powered spray liquid heaters shall be approved by Standardization & Metrology Organization for GCC Countries and listed for the specific location in which they are used (see item 4.2). Heaters shall not be located in spray booths nor in other locations subject to the accumulation of deposits or combustible residue. Agitators, if used, should preferably be driven by compressed air, water, or low-pressure steam. If an electric motor is used, it shall comply with the requirement in item 4.2

#### 4.4.8 Pump Relief

If flammable or combustible liquids are supplied to spray nozzles by positive displacement pumps, the pump discharge line shall be provided with a Standardization & Metrology Organization for GCC Countries approved relieve valve discharging to a pump suction or a safe detached location, or a device

provided to stop the prime mover if the discharge pressure exceeds the safe operating pressure of the system.

#### 4.4.9 Grounding

Both containers shall be effectively bonded and grounded to prevent discharge sparks of static electricity whenever flammable or combustible liquids are transferred from one container to another.

#### 4.5 Protection

4.5.1 Conformance In sprinklered buildings, the automatic sprinkler system in rooms containing spray finishing operations shall conform to the requirements of item 4.2. In unsprinklered buildings where sprinklers are installed only to protect spraying areas, the installation shall conform with such standards insofar as they may be applicable. Sprinkler heads shall be located to effect water distribution throughout the entire booth.

#### 4.5.2 Valve Access

Automatic sprinklers protecting each spray booth (together with its connection exhaust) shall be under an accessibly located separate outside stem and yoke subcontrol valve.

#### 4.5.3 Cleaning of Heads

Sprinklers protecting spraying areas shall be kept as free from deposits as practical by cleaning daily if necessary (See item 4.2).

#### 4.5.4 Portable Extinguishers

A supply of suitable portable fire extinguishers shall be installed near all spraying areas, with a minimum of one inside the booth and one outside the door.

#### 4.6 Operations and Maintenance

##### 4.6.1 Spraying

Spraying shall not be conducted outside the predetermined spraying areas.

##### 4.6.2 Cleaning

All spraying areas shall be daily kept as free from the accumulation of deposits of combustible residues as practical, with cleaning if necessary. Scrapers, spuds, or other such tools used for cleaning purposes shall be of nonsparking material.

##### 4.6.3 Residue Disposal

Residue scrapings and debris contaminated with residue shall be immediately removed from the premises and properly disposed of. Approved metal waste cans shall be provided wherever rags or waste are impregnated with finishing material and all such rags or waste deposited therein immediately after use. The contents of waste cans shall be properly disposed of at least once daily or at the end of each shift.

##### 4.6.4 Clothing Storage

Spray finishing employees' clothing shall not be left on the premises overnight unless kept in metal lockers.



**4.6.5 Cleaning Solvents**

The use of solvents for cleaning operations shall be restricted to those having flash points not less than 37°C; however, for cleaning spray nozzles and auxiliary equipment, solvents having flash-points not less than those normally used in spray operations may be used. Such cleaning shall be conducted inside spray booths and ventilating equipment operated during cleaning.

**4.6.6 Hazardous Materials Combinations**

Spray booths shall not be alternately used for different types of coating materials, where the combination of the materials may be conducive to spontaneous ignition, unless all deposits of the first used material are removed from the booth and exhaust ducts prior to spraying with the second used material.

**4.6.7 “No Smoking” Signs**

“No Smoking” signs in large letters on contrasting colour background shall be conspicuously posted at all spraying areas and paint storage rooms.

**4.7 Fixed Electrostatic Apparatus****4.7.1 Conformance**

Where installation and use of electrostatic spraying equipment is used, such installation and use shall conform to the requirements of this item.

**4.7.2 Type Approval**

Electrostatic apparatus and devices used in connection with coating operations shall be of Standardization & Metrology Organization for GCC Countries approved types.

**4.7.3 Location**

Transformers, power packs, control apparatus, and all other electrical portions of the equipment, with the exception of high-voltage grids, electrodes, and electrostatic atomizing heads and their connections, shall be located outside of the spraying area, or shall otherwise conform to the requirements of item 4.2.

**4.7.4 Support**

Electrodes and electrostatic atomizing heads shall be adequately supported in permanent locations and shall be effectively insulated from the ground. Electrodes and electrostatic atomizing heads which are permanently attached to their bases, supports, or reciprocators, shall be deemed to comply with this standard. Insulators shall be nonporous and noncombustible.

**4.7.5 Insulators, Grounding**

High-voltage leads to electrodes shall be properly insulated and protected from mechanical injury or exposure to destructive chemicals. Electrostatic atomizing heads shall be effectively and permanently supported on suitable insulators and shall be effectively guarded against accidental contact or grounding. An automatic means shall be provided for grounding the electrode system when it is electrically doenergized for any reason. All insulators shall be kept clean and dry.

**4.7.6 Safe Distance**

A safe distance shall be maintained between goods being painted and electrodes or electrostatic atomizing heads or conductors of at least twice the sparking distance. A suitable sign indicating this safe distance shall be conspicuously posted near the assembly.

**4.7.7 Conveyors Required**

Goods being painted using this process are to be supported on conveyors. The conveyors shall be so arranged as to maintain safe distances between the goods and the electrodes or electrostatic atomizing heads at all times. Any irregularly shaped or other goods subject to possible swinging or movement shall be rigidly supported to prevent such swinging or movement which would reduce the clearance to less than that specified in item 4.7.6.

**4.7.8 Prohibition**

This process is not acceptable where goods being coated are manipulated by hand. When finishing materials are applied by electrostatic equipment which is manipulated by hand, see item 4.8 for applicable requirements.

**4.7.9 Fail-Safe Controls**

Electrostatic apparatus shall be equipped with automatic controls which will operate without time delay to disconnect the power supply to the high voltage transformer and to signal the operator under any of the following conditions:

4.7.9.1 Stoppage of ventilating fans or failure of ventilating equipment for any reason.

4.7.9.2 Stoppage of the conveyor carrying goods through the high voltage field.

4.7.9.3 Occurrence of a ground or of an imminent ground at any point on the high voltage system.

4.7.9.4 Reduction of clearance below that specified in item 4.7.6.

**4.7.10 Guarding**

Booths, fencing, railings, or guards shall be so placed about the equipment that they, either by their location or character or both, assure that a safe isolation of the process is maintained from plant storage or personnel. Such railings, fencing, and guards shall be grounded and made of a conducting material.

**4.7.11 Ventilation**

Where electrostatic atomization is used, the spraying area shall be so ventilated as to insure safe conditions from a fire and health standpoint.

**4.7.12 Fire Protection**

All areas used for spraying, including the interior of the booth, shall be protected by automatic sprinklers where this protection is available. Where this protection is not available, other automatic extinguishing equipment shall be provided.

**4.8 Electrostatic Hand Spraying Equipment****4.8.1 Application**

This item shall apply to any equipment using electrostatically charged elements for the atomization and/or, precipitation of materials for coatings on articles, or for other similar purposes in which the atomizing device is hand held and manipulated during the spraying operation.

4.8.2 Conformance Electrostatic hand spraying equipment shall conform with the other provisions of this item.

4.8.3 Equipment Approval and Specifications

Electrostatic hand spray apparatus and devices used in connection with coating operations shall be of Standardization & Metrology Organization for GCC Countries approved types. The equipment should be so designed that the maximum surface temperature of the equipment in the spraying area shall not exceed 65°C under any condition. The high voltage circuits shall be designed to produce no spark of sufficient intensity to ignite any vapour-air mixtures nor result in appreciable shock hazard upon coming in contact with a ground object under all normal operation conditions. The electrostatically charged exposed elements of the handgun shall be capable of being energized only by a switch which also controls the coating material supply.

4.8.4 Electrical Support Equipment

Transformers, powerpacks, control apparatus, and all other electrical portions of the equipment, with the exceptions of the handgun itself and its connections to the power supply shall be located outside the spraying area or shall otherwise conform to the requirements of item 4.2.

4.8.5 Spray Gun Ground

The handle of the spraying gun shall be electrically connected to ground by a metallic connection and to be so constructed that the operator in normal operating position is in intimate electrical contact with the grounded handle.

4.8.6 Grounding-General

All electrically conductive objects in the spraying area shall be adequately grounded. This requirement shall apply to paint containers, wash cans, and any other objects or devices in the area. The equipment shall carry a prominent permanently installed warning regarding the necessity for this grounding feature.

4.8.7 Maintenance of Grounds

Objects being painted or coated shall be maintained in metallic contact with the conveyor or other grounded support. Hooks shall be regularly cleaned to insure this contact and areas of contact shall be sharp points or knife edges where possible. Points of support of the object shall be concealed from random spray where feasible and where the objects being sprayed are supported from a conveyor, the point of attachment to the conveyor shall be so located as to collect no spray material during normal operation.

4.8.8 Interlocks

The electrical equipment shall be so interlocked with the ventilation of the spraying area that the equipment cannot be operated unless the ventilation fans are in operation.

## 4.8.9 Ventilation

The spraying operation shall take place within a spray area which is ventilated to remove solvent vapours released from the operation.

4.9 **Drying, Curing, or Fusion Apparatus**

## 4.9.1 Conformance

Drying, curing, or fusion apparatus in connection with spray application of flammable and combustible finishes shall be located with consideration to the possibility of a fire resulting from the unintentional ignition of spray or furnace fuel. Oven heaters will be of the indirect fired type so as to further reduce the possibility of a fire. Ventilation will supply fresh air and exhaust so as to dilute any flammable vapours sufficiently to below the lower explosive limits. See item 4.3.

## 4.9.2 Alternate Use Prohibited

Spray booths, rooms, or other enclosures used for spraying operations shall not alternately be used for the purpose of drying by an arrangement which will cause a material increase in the surface temperature of the spray booth, room, or enclosure.

## 4.9.3 Adjacent System interlocked

Except as specifically provided in item 4.9.4, drying, curing, or fusion units utilizing a heating system having open flames or which may produce sparks shall not be installed in a spraying area, but may be installed adjacent thereto when equipped with an interlocked ventilating system arranged to:

4.9.3.1 Thoroughly ventilate the drying space before the heating system can be started.

4.9.3.2 Maintain a safe atmosphere at any source of ignition.

4.9.3.3 Automatically shut down the heating system in the event of failure of the ventilating system.

## 4.9.4 Alternate Use Permitted

Automobile refinishing spray booths or enclosures, otherwise installed and maintained in full conformity with this standard, may alternated be used for drying with portable electrical infrared drying apparatus when conforming with the following:

4.9.4.1 Interior (especially floors) of spray enclosures shall be kept free of overspray deposits.

4.9.4.2 During spray operations, the drying apparatus and electrical connections and wiring thereto shall not be located within spray enclosure nor in any other location where spray residues may be deposited thereon.

4.9.4.3 The spraying apparatus, the drying apparatus, and the ventilating system of the spray enclosure shall be equipped with suitable interlocks so arranged that.

4.9.4.4 The spraying apparatus cannot be operated while the drying apparatus is inside the spray enclosure.

- 4.9.4.5 The spray enclosure will be purged of spray vapours for a period of not less than 3 min. before the drying apparatus can be energized.
- 4.9.4.6 The ventilating system will maintain a safe atmosphere within the enclosure during the drying process and the drying apparatus will automatically shut off in the event of failure of the ventilating system.
- 4.9.4.7 All electrical wiring and equipment of the drying apparatus shall conform with the Gulf Standard mentioned in item 2.1. Only equipment of a type approved for Class 1, Division 2 hazardous locations shall be located within 45 cm of floor level. All metallic parts of the drying apparatus shall be properly electrically bonded and grounded.
- 4.9.4.8 The drying apparatus shall contain a prominently located, permanently attached warning sign indicating that ventilation should be maintained during the drying period and that spraying should not be conducted in the vicinity that spray will deposit on apparatus.

#### 4.10 **Automobile Undercoating in Garages**

Automobile undercoating spray operations in garages, conducted in areas having adequate natural or mechanical ventilation, are exempt from the requirements pertaining to spray finishing operations, when using undercoating materials not more hazardous than kerosene or undercoating materials using only solvents listed as having a flash point in excess of 37°C.

Undercoating spray operations not conforming to these provisions are subject to all requirements of this item pertaining to spray finishing operations.

#### 4.11 Powder Coating

##### 4.11.1 Electrical and Other Sources of Ignition

Electrical equipment and other sources of ignition shall conform to the requirements of items 4.2.1, 4.2.8, 4.2.9 and the Gulf Standard mentioned in item 2.1.

##### 4.11.2 Ventilation

In addition to the provisions of item 4.3, where applicable, exhaust ventilation shall be sufficient to maintain the atmosphere below the lowest explosive limits for the materials being applied. All nondeposited air-suspended powders shall be safely removed via exhaust ducts to the powder recovery cyclone or receptacle. Each installation shall be designed and operated to meet the foregoing performance specification. Powders shall not be released to the outside atmosphere.

##### 4.11.3 Drying, Curing, or Fusion Equipment, See item 4.9.

##### 4.11.4 Operator and Maintenance

All areas shall be kept free from the accumulation of powder coating dusts, particularly such horizontal surfaces as ledges, beams, pipes, hoods, booths, and floors.

##### 4.11.4.1 Surfaces shall be cleaned in such manner as to avoid scattering dust to other places or creating dust clouds.

- 4.11.4.2 “No Smoking” signs in large letters on contrasting colour background shall be conspicuously posted at all powder coating areas and powder storage rooms.
- 4.11.5 Fixed Electrostatic Spraying Equipment
- The provisions of item 4.7 and its other subsequent items shall apply to fixed electrostatic equipment, except that electrical equipment not covered therein shall conform to item 4.11.1.
- 4.11.6 Electrostatic Hand Spraying Equipment
- The provisions of item 4.8 and its other subsequent items, shall apply to electrostatic handguns when used in powder coating, except that electrical equipment not covered therein shall conform to item 4.11.1.
- 4.11.7 Electrostatic Fluidized Beds
- Electrostatic fluidized beds and associated equipment shall be of approved types. The maximum surface temperature of this equipment in the coating area shall not exceed 65°C. The high voltage circuits shall be so designed as to not produce a spark of sufficient intensity to ignite any powder-air mixtures nor result in appreciable shock hazard upon coming in contact with a ground object under normal operation conditions.
- 4.11.7.1 Transformers, powerpacks, control apparatus, and all other electrical portions of the equipment, with the exception of the charging electrodes and their connections to the power supply shall be located outside of the powder coating area or shall otherwise conform to the requirements of item 4.11.1.
- 4.11.7.2 All electrically conductive objects within the charging influence of the electrodes shall be adequately grounded. The powder coating equipment shall carry a prominent, permanently installed warning regarding the necessity for grounding these objects.
- 4.11.7.3 Objects being coated shall be maintained in contact with the conveyor or other support in order to insure proper grounding. Hangers shall be regularly cleaned to insure effective contact and areas of contact shall be sharp points or knife edges where possible.
- 4.11.7.4 The electrical equipment shall be so interlocked with the ventilation system that the equipment cannot be operated unless the ventilation fans are in operation.
- 4.12 Organic Peroxides and Dual Component Coatings
- 4.12.1 Conformance
- All spraying operations involving the use of organic peroxides and other dual component coatings shall be conducted in approved sprinklered spray booths meeting the requirements of this item.
- 4.12.2 Smoking
- Smoking shall be prohibited and “No Smoking” signs shall be prominently displayed and only nonsparking tools shall be used in any area where organic peroxides are stored, mixed or applied.